

CBA-Series Scotch-Yoke Pneumatic Actuators

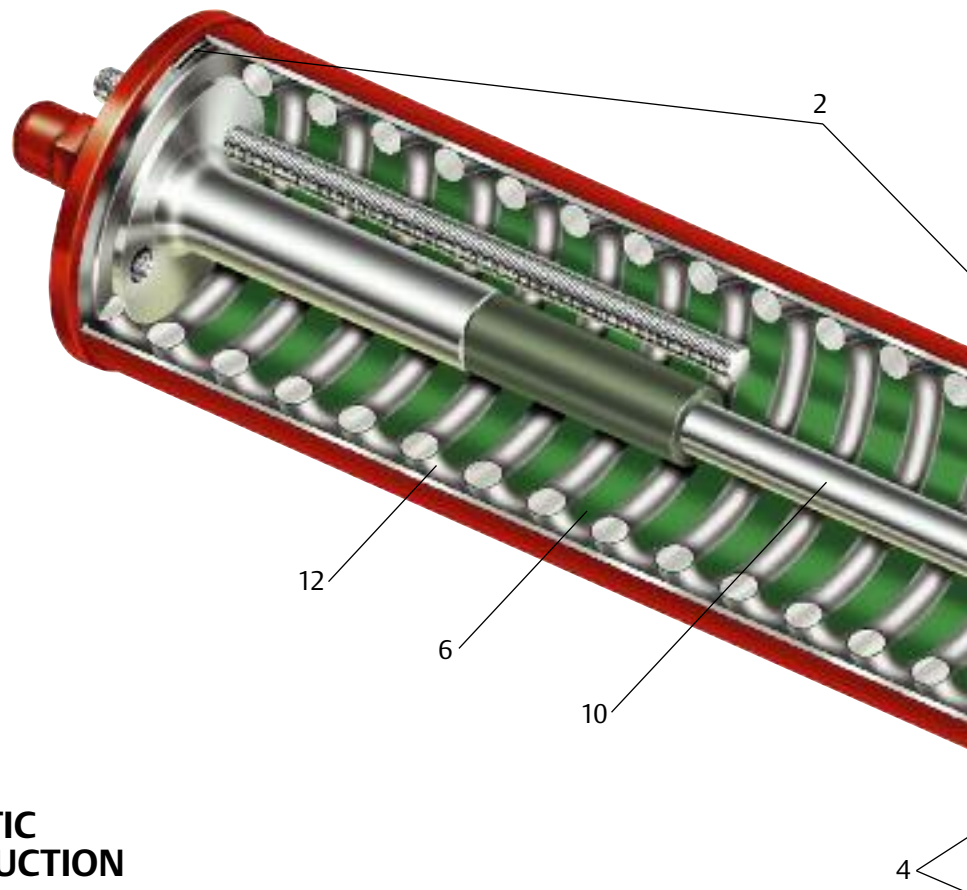
Compact, Lightweight and Economical



BETTIS®


EMERSON™
Process Management

- PED 97/23/EC Compliant
- Xylan™ Coated Cylinder
- Water Ingress Protected – IP66 and IP67M
- Low Maintenance
- Economical
- Jackscrew Option
- Five-Year Warranty
- Dual Mounting Interface
- Suitable for SIL 2 or SIL 3
- Bi-directional Travel Adjustment



CBA-SERIES PNEUMATIC DESIGN AND CONSTRUCTION

Mechanical Components

The Bettis CBA-Series pneumatic actuators are compact, lightweight and ideally suited for automating ball, butterfly and non-lubricated plug valves, or any quarter-turn (90 degree) rotating mechanism. These economical, low maintenance actuators provide a reliable means of automating your valve. Available with optional features and controls to meet your most demanding automation needs. The CBA-Series, available in double-acting and spring-return models, are independently certified to BS 5490: 1977 - IP66 and IP67M for water ingress protection.

Operating Ranges

Double-acting CBA-Series actuators are available with guaranteed minimum torque outputs to 11,515 lb-in (1,301 Nm).

The CBA-Series spring-return models require pressure in only one direction of travel and are suitable for fail clockwise or counterclockwise applications without modification. These models produce guaranteed spring ending torques to 4,269 lb-in (482 Nm).

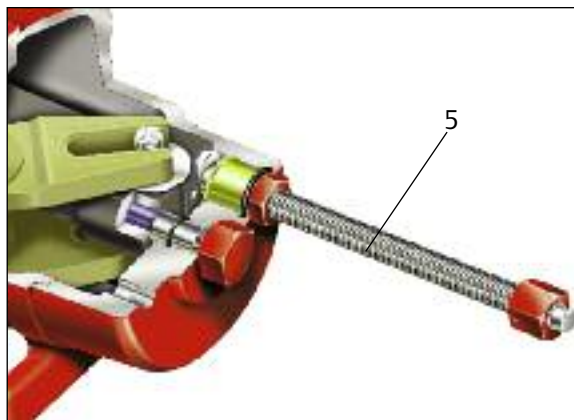
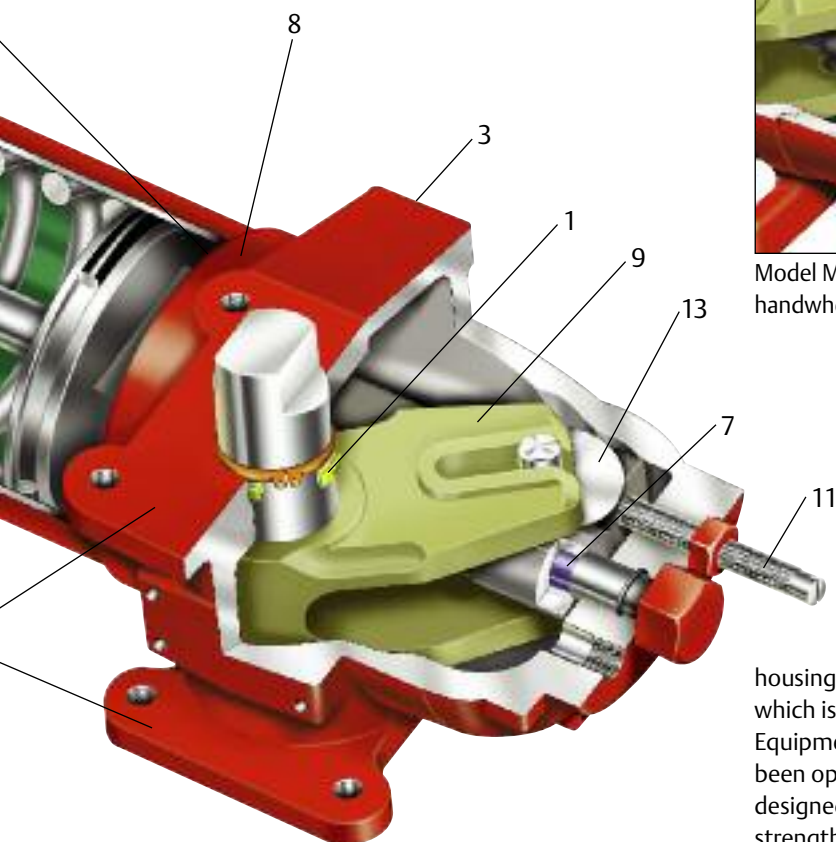
Standard construction CBA-Series actuators are designed for operating temperatures of -20°F to +200°F (-29°C to +93°C). High temperature trim allows continuous operation from 0°F to +350°F (-18°C to +177°C). Additionally, special non-PED low temperature trim allows operation to -40°F (-40°C). Consult factory when

temperature requirements exceed these limits. Operating pressures for the CBA-Series range from 40 to 150 PSIG (3 to 10 BAR).

Design Features

Water Ingress Protection – The CBAs meet both IP66 and IP67M specifications for submergence and severe high pressure water deluge test, offering superior water ingress protection and corrosion resistance. The actuator has no gaskets and is totally o-ring sealed.

- 1) **New, Outer Lip-Type Torque Shaft Seals** restrict external contaminants, providing a high level of corrosion and water-resistance.
- 2) **New O-Ring Sealed Cylinders** essentially eliminate the possibility of any cylinder leakage throughout the full range of operating and climatic conditions.
- 3) **Standard Accessory Mounting Pad** – The new accessory mounting pad is standard and identical on all CBA and CBA-300 Series models, allowing the panel mounting of controls.
- 4) **Dual Valve Mounting Interface** allows the flexibility to change the actuator fail mode, without disassembly, by simply inverting the actuator. They may be installed in any position; parallel or at right angles to the flow line, in the vertical or the horizontal plane.



Model M3 Jackscrew shown (M3HW with optional handwheel not pictured).

5) Jackscrew Option – A blowout-proof economical jackscrew manual override is available as an option to the CBA models (see inset above). The jackscrew also acts as a stop adjustment screw.

This feature has several advantages:

- Produces full rated torque output in the event of air supply loss.
- During normal power operation, the manual override has no effect on actuator torque output or operating speed.
- Double-acting actuator models are available with one or two jackscrews.

6) Xylan™ Cylinder Coating, the standard internal coating on all CBA-Series actuators. This fluoropolymer coating is highly resistant to abrasion, thermal shock and provides excellent lubricity and low friction properties. Corrosive salts and other chemicals normally found in the atmosphere or instrument air supply system will not adversely affect its performance. Xylan™ bonds to the chemically prepared surface of the steel cylinder so effectively that, unlike other coatings, cracking and flaking are virtually eliminated.

7) New Piston Heel and Yoke Pin Bearings

– The CBA features PTFE/bronze bearings on the actuator's piston heel and yoke pin. These bearings help to assure smooth and consistent torque output, while enhancing total cycle life.

8) Ductile Iron Housing – CBA actuator

housings are made of pressure vessel quality ductile iron which is approved for use by ASME and the Pressure Equipment Directive (PED 97/23/EC). All housings have been optimized by finite element analysis and are designed for light weight while retaining maximum strength, ductility and corrosion resistance.

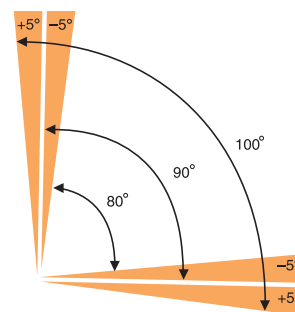
9) The Scotch-Yoke Mechanism transforms linear movement of the piston into a 90 degree rotation, providing optimum torque curves, ideal for most quarter-turn valve applications.

10) Center Bar, made of improved high strength alloy steel, guides the piston throughout its full stroke, preventing metal to metal contact with the cylinder bore.

11) Bi-directional Travel Stops are an integral part of the actuator allowing 80° to 100° total travel adjustment. Extended travel stops are optional. This feature provides an unmatched travel range to assist in prolonging valve seat integrity.

12) Springs – High-strength, high-performance alloy carbon steel springs are protected by Tactyl 50, a pliable self-healing coating. Bettis takes an additional step and shot peens the springs, helping to extend the actuator's spring cycle life.

13) Yoke Arm Bearing Washer – Acetal bearings positively prevent metal-to-metal contact, helping to assure smooth and consistent torque output.



SIZING AND SELECTION

General Definitions

To clarify and standardize terminology, Bettis offers the following definitions for terms commonly used. Please become familiar with and use the following standard definitions when referring to Bettis quarter-turn actuators.

Quarter-turn: A device which rotates a minimum of 90 degrees. All Bettis quarter-turn actuators will rotate more than 90 degrees.

Position: That degree of rotation describing an actuator's current location. The mid position of a quarter-turn actuator is generally at forty-five (45) degrees.

CW: Clockwise rotation.

CCW: Counterclockwise rotation.

Stroke: A continuous, ninety (90) degree rotation of a quarter-turn actuator. Bettis spring-return actuators have two (2) different strokes, a pressure stroke and a spring stroke. Bettis double-acting actuators have two (2) pressure strokes. Note that rack and pinon actuators have common torque values for both pressure strokes, while scotch yoke actuators have different torque values depending on which side of the piston is doing the work.

Cycle: The collective reference to two (2) strokes, one (1) for clockwise (CW) rotation and one (1) for counterclockwise (CCW) rotation. Bettis actuators must rotate through two (2) stroke to complete one (1) cycle.

Safety Factor: Represents a protective component (an adjustment to torque requirement) sometimes added to a valve's required torque value. Often used when the user/specifier is not certain of the valve's torque requirements, or because of other application concerns.

Sizing Bettis Actuators

The following information is generally the minimum required for sizing Bettis quarter-turn pneumatic and hydraulic actuators for specific valve requirements.

A) An accurate maximum torque requirement must be obtained before actuator sizing begins. Normal maximum stem torque for a properly applied and maintained valve is usually defined as: The maximum starting torque required to rotate the valve element (ball, disc, plug, etc.) from a fully closed position (unsealing), against the maximum normal valve rated different pressures. Most valve manufacturers make adjustments in the form of torque amendments under various operating conditions. Application operating conditions such as temperature extremes, actual differential pressure, unusual loading, high flow rates, operating speeds, etc. are some of the most common causes for adjustments.

Bettis recommends that the valve manufacturer supply the maximum required torque value(s) (**including any adjustments or suggested safety factors**). Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (CCW or CW) these maximum requirements occur.

B) Bettis actuators include stops which will resist the maximum rated torque output of the actuator. The possibility exists, that should the valve become immobilized during rotation, the actuator could exceed the maximum allowable valve input torque rating. If this possibility is a concern, your application needs further review.

Once the maximum torque requirements, its position, and direction of rotation are identified, the appropriate Bettis actuator can be selected from torque output charts on pages 4–7.

Actuator Selection Procedures

- A)** Determine the type of Bettis actuator required: double-acting or spring-return.
- B)** Determine the power supply media: pneumatic or hydraulic, and the minimum/maximum supply pressure(s) at the actuator.
- C)** Using this information, select the applicable torque rating table and see the appropriate following examples.

Scotch-Yoke, Double-Acting Actuators (example assumes CW to close)

Note: The valve's torque requirements must be exceeded by the actuator's torque output at all corresponding positions and directions of rotation.

Bettis has included Start, Minimum, and End pressure torque outputs for your use.

- A)** Using your minimum operating pressure, select an operating pressure column from the Pressure Torque Rating Section of less than or equal pressure. Move down the column until both starting and minimum output torques are found which exceed the valve's maximum and minimum torque requirements. Determine the Bettis model number at the left, under the model number column.
- B)** Once a Bettis actuator model has been selected, use the performance data tables to ensure your maximum supply pressure does not exceed the maximum operating pressure (M.O.P.) for your Bettis actuator. If the actuator selected is not rated for your maximum supply pressure, either the maximum supply pressure must be reduced or an actuator rated for a higher M.O.P. must be selected.

Scotch-Yoke, Spring-Return, Fail CLOCKWISE Actuators (example assumes CW to close)

Note: The valve's maximum torque requirements must be exceeded by the actuator's torque output at all corresponding positions and directions of rotation.

Bettis has included Start, Minimum, and End Spring Torque outputs, as well as Start, Minimum and End Pressure Torque Outputs for your use. The minimum torque outputs listed on the Spring-Return torque charts are the lowest value of torque output available at any position, during either stroke (pressure or spring).

- A)** Select from the Spring Torque column a Spring Ending torque output which exceeds that of the valve's maximum seating requirement.
- B)** Proceed to the right using your minimum operating pressure and select an operating pressure column from the Pressure Torque Rating Section of less than or equal pressure. The Pressure Start torque output must exceed the valve's torque requirement at this position (unseating). The Pressure End torque output must exceed the valve's torque requirement at this position (full flow) and direction of rotation (CCW).
- C)** Once a Bettis actuator model has been selected, use the performance data tables to ensure your maximum supply pressure does not exceed the maximum operating pressure (M.O.P.) for your Bettis actuator. If the actuator selected is not rated for your maximum supply pressure, either the maximum supply pressure must be reduced or an actuator rated for a higher M.O.P. must be selected.

Contact your local Authorized Bettis distributor or a Bettis manufacturing facility if you require assistance.

Performance Data – CBA-Series (Pneumatic) – Imperial & metric

Double-Acting Actuators CBA-Series

Actuator Model	Volumes				Maximum Operating Pressure (MOP) *		Maximum Allowable Working Pressure (MAWP) **		Approximate Weight of Actuator (MAWP) **	
	Outboard		Inboard (Housing)							
	Cu. Inches	Cubic CM	Cu. Inches	Cubic CM	PSIG	Bar	PSIG	Bar	Lbs.	KG
CBA 315	24	393.3	54	885.0	120	8.3	200	13.8	20	9.1
CBA 420	53	868.5	115	1884.5	120	8.3	200	13.8	22	10.0
CBA 520	83	1360.1	148	2425.3	70	4.8	160	11.0	28	12.7
CBA 525	105	1720.6	207	3392.1	120	8.3	200	13.8	44	20.0
CBA 725	208	3408.5	327	5358.6	80	5.5	160	11.0	68	31.0

Spring-Return Actuators CBA-Series

Actuator Model	Volume		Maximum Operating Pressure (MOP) *		Maximum Allowable Working Pressure (MAWP) **		Approximate Weight of Actuator	
	Cu. Inches	Cubic CM	PSIG	Bar	PSIG	Bar		
◆ CBA 315- SR40	54	885	155	10.7	200	13.8	22	10.0
SR60	54	885	152	10.5	200	13.8	23	10.4
SR80	54	885	150	10.3	200	13.8	26	11.8
SR100	54	885	164	11.3	200	13.8	25	11.4
◆ CBA 415- SR40	75	1229	100	6.9	160	11.0	27	12.7
SR60	75	1229	112	7.7	160	11.0	29	14.1
SR80	75	1229	117	8.1	160	11.0	30	14.1
SR100	75	1229	114	7.9	160	11.0	31	14.1
◆ CBA 420- SR40	115	1884.5	157	10.8	200	13.8	37	16.8
SR60	115	1884.5	156	10.8	200	13.8	39	17.7
SR80	115	1884.5	161	11.0	200	13.8	40	18.1
SR100	115	1884.5	166	11.4	200	13.8	41	18.6
◆ CBA 520- SR40	148	2425.3	110	7.6	160	11.0	45	20.4
SR60	148	2425.3	116	8.0	160	11.0	48	21.8
SR80	148	2425.3	120	8.3	160	11.0	49	22.2
SR100	148	2425.3	132	9.1	160	11.0	53	24.0
◆ CBA 525- SR40	207	3392	146	10.1	200	13.8	62	28.1
SR60	207	3392	151	10.4	200	13.8	65	29.5
SR80	207	3392	159	11.0	200	13.8	65	29.5
SR100	207	3392	163	11.2	200	13.8	67	30.4
◆ CBA 725- SR40	327	5358.6	102	7.0	160	11.0	97	44.0
SR60	327	5358.6	115	8.0	160	11.0	98	44.5
SR80	327	5358.6	124	8.6	160	11.0	104	47.2
SR100	327	5358.6	124	8.6	160	11.0	107	48.5

Notes:

- ◆ CBA-SRXXM mechanical handwheel overrides are available on these models. The override adds approximately 2 lbs. (.8 kg) to the weight of the standard CBA model.
- ▲ Maximum volume including cavity required for calculating consumption per stroke.
- * **Maximum Operating Pressure (MOP)** is the pressure required to produce the maximum rated torque of the actuator.
- ** **Maximum Allowable Working Pressure (MAWP)** is the maximum static pressure that may be applied to a fully stroked actuator against the travel stops.

Standard installation produces clockwise rotation when the outboard side of piston is pressurized.
Standard installation produces counterclockwise rotation when the inboard side of piston is pressurized.

Note: Actuator may be installed opposite of that shown above.



Torque Ratings – CBA-Series (Pneumatic) – Imperial

All Published Torques are Typical Minimum Values.

Double-Acting Actuators

CBA-Series

Actuator Model	See Bettis' Definitions	Operating Pressure (PSIG)							
		40	50	60	70	80	90	100	120
		Pressure Torque Output Start/Min./End (lb-in)							
CBA 315	Start/End	678	848	1017	1187	1356	1526	1695	2034
	Minimum	404	505	606	707	808	910	1011	1213
CBA 420	Start/End	1536	1921	2305	2689	3073	3457	3841	4609
	Minimum	871	1089	1307	1525	1743	1961	2179	2614
CBA 520	Start/End	2133	2666	3200	3733				
	Minimum	1302	1628	1954	2279				
CBA 525	Start/End	2944	3680	4416	5152	5888	6624	7361	8833
	Minimum	1720	2150	2580	3009	3439	3869	4299	5159
CBA 725	Start/End	5757	7197	8636	10075	11515			
	Minimum	3434	4292	5151	6009	6868			

Notes:

Start: (starting) That torque output position at which an actuator produces its greatest torque output. The starting torque outputs listed in Bettis scotch-yoke torque output charts are the lesser of the two (2) pressure strokes, when there is a difference (different areas).

Minimum: (min.) That torque output, at an intermediate position, at which an actuator produces its lowest torque output. The minimum torque outputs shown on Bettis pressure torque output charts are the lowest torque values produced during the pressure stroke(s). For double-acting actuators, this is also the mid position.

End: (ending) That torque output position at which an actuator has reached the limit of a pressure stroke. For double-acting actuators the end torque output is equal to the start torque output.

Spring-Return Actuators

CBA-Series

Actuator Model	Spring Torque Start/Min./End (lb-in)	Operating Pressure (PSIG)								
		40	50	60	70	80	90	100	120	150
		Pressure Torque Output Start/Min./End (lb-in)								
CBA315 SR40	Start	350	375	531	688	844	1000	1157	1313	1626
	Min.	151	158	247	336	424	512	600	688	864
	End	202	216	377	538	698	859	1020	1181	1502
CBA315 SR60	Start	598		438	608	778	948	1117	1287	1627
	Min.	238		153	249	343	436	530	623	808
	End	305		172	342	512	681	851	1021	1360
CBA315 SR80	Start	757				698	884	1069	1254	1625
	Min.	306				237	328	418	509	689
	End	402				312	498	683	869	1239
CBA315 SR100	Start	1069						876	1053	1406
	Min.	405						331	428	621
	End	494						421	600	957
CBA415 SR40	Start	682	692	981	1271	1560	1850	2139	2429	
	Min.	284	285	451	614	778	941	1105	1268	
	End	365	387	701	1014	1328	1641	1955	2269	
CBA415 SR60	Start	1076		701	979	1256	1533	1811	2088	
	Min.	431		264	435	603	770	934	1099	
	End	577		294	600	905	1211	1516	1822	
CBA415 SR80	Start	1345				1077	1362	1648	1933	
	Min.	576				428	602	772	942	
	End	711				510	811	1113	1414	
CBA415 SR100	Start	1659						1701	2007	
	Min.	673						542	719	
	End	756						564	861	

Torque Ratings – CBA-Series (Pneumatic) – metric

All Published Torques are Typical Minimum Values.

Double-Acting Actuators

CBA-Series

Actuator Model	See Bettis' Definitions	Operating Pressure (Bar)							
		3	3.5	4	5	5.5	6	7	8
		Pressure Torque Output Start/Min./End (Nm)							
CBA315	Start/End	83	97	111	139	153	167	194	222
	Minimum	50	58	66	83	91	99	116	133
CBA420	Start/End	189	220	252	315	346	378	441	504
	Minimum	107	125	143	179	196	214	250	286
CBA520	Start/End	262	306	350	437				
	Minimum	160	187	213	267				
CBA525	Start/End	362	422	482	603	663	724	844	965
	Minimum	211	247	282	352	387	423	493	564
CBA725	Start/End	708	826	944	1179	1297			
	Minimum	422	492	563	703	774			

Notes:

Start: (starting) That torque output position at which an actuator produces its greatest torque output. The starting torque outputs listed in Bettis scotch-yoke torque output charts are the lesser of the two (2) pressure strokes, when there is a difference (different areas).

Minimum: (min.) That torque output, at an intermediate position, at which an actuator produces its lowest torque output. The minimum torque outputs shown on Bettis pressure torque output charts are the lowest torque values produced during the pressure stroke(s). For double-acting actuators, this is also the mid position.

End: (ending) That torque output position at which an actuator has reached the limit of a pressure stroke. For double-acting actuators the end torque output is equal to the start torque output.

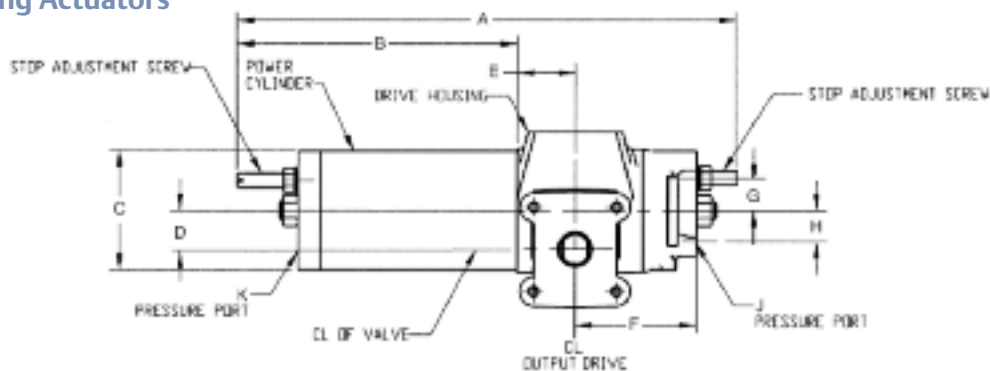
Spring-Return Actuators

CBA-Series

Actuator Model	Spring Torque Start/Min/End (Nm)	Operating Pressure (Bar)										
		3	3.5	4	5	5.5	6	7	8	9	10	11
		Pressure Torque Output Start/Min./End (Nm)										
CBA315-SR40	Start	39	49	61	74	100	113	125	151	177	202	228
	Min.	17	21	29	36	51	58	65	79	94	108	123
	End	23	31	44	57	84	97	110	136	162	189	215
CBA315-SR60	Start	68		51	65	93	107	121	148	176	204	232
	Min.	27		18	26	41	49	57	72	87	102	117
	End	34		21	35	63	76	90	118	146	174	202
CBA315-SR80	Start	86				84	99	115	145	175	206	236
	Min.	35				29	37	44	59	74	89	103
	End	45				41	56	71	101	132	162	192
CBA315-SR100	Start	121						93	122	151	180	209
	Min.	46						34	50	66	81	97
	End	56						42	71	100	129	159
CBA415-SR40	Start	77	90	113	137	185	208	232	279			
	Min.	32	39	52	66	93	106	119	146			
	End	41	56	82	108	159	185	210	262			
CBA415-SR60	Start	122		82	104	150	173	195	241			
	Min.	49		31	45	73	87	100	127			
	End	65		36	61	111	136	161	211			
CBA415-SR80	Start	152				130	153	176	223	270		
	Min.	65				53	68	82	109	137		
	End	80				66	91	116	165	214		
CBA415-SR100	Start	187						182	232			
	Min.	76						54	84			
	End	85						54	102			

Dimensions – CBA-Series (Pneumatic) – Imperial

Double-Acting Actuators CBAXXX

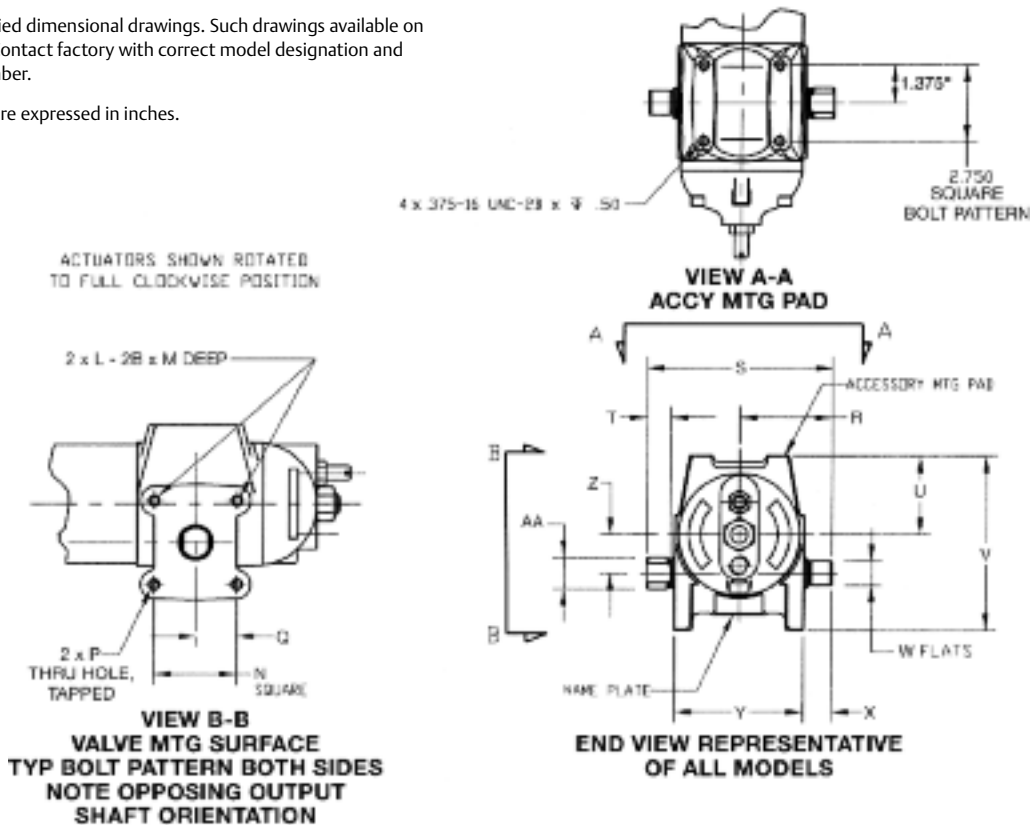


Actuator Model	A	B	C	D	E	F	G	H	J/K	L	M	N
CBA315	14.16	7.38	3.25	1.09	1.88	3.46	0.94	.94	1/4" NPT	.313-18 UNC	.38	2.250
CBA420	16.43	8.57	4.25	1.38	2.13	4.37	1.10	1.10	3/8" NPT	.375-16 UNC	.50	3.000
CBA520	16.46	8.63	5.38	1.38	2.07	4.37	1.10	1.10	3/8" NPT	.375-16 UNC	.50	3.000
CBA525	19.22	9.88	5.38	1.69	2.56	5.00	1.25	1.25	3/8" NPT	.500-13 UNC	.50	3.500
CBA725	19.44	10.24	7.50	1.69	2.53	5.00	1.25	1.25	3/8" NPT	.500-13 UNC	.50	3.500

Actuator Model	P	Q	R	S	T	U	V	W	X	Y	Z	AA
CBA315	.313-18 UNC	1.125	2.91	5.81	.75	2.22	5.18	.614 .620	1.03	3.75	1.09	0.873 0.875
CBA420	.375-16 UNC	1.500	3.35	6.69	.75	2.81	6.25	.864 .870	1.03	4.63	1.38	1.123 1.125
CBA520	.375-16 UNC	1.500	3.35	6.69	.75	2.81	6.25	.864 .870	1.03	4.63	1.38	1.121 1.125
CBA525	.500-13 UNC	1.750	4.38	8.75	1.12	3.50	7.58	1.115 1.121	1.50	5.75	1.69	1.498 1.500
CBA725	.500-13 UNC	1.750	4.38	8.75	1.12	3.50	7.58	1.115 1.121	1.50	5.75	1.69	1.498 1.500

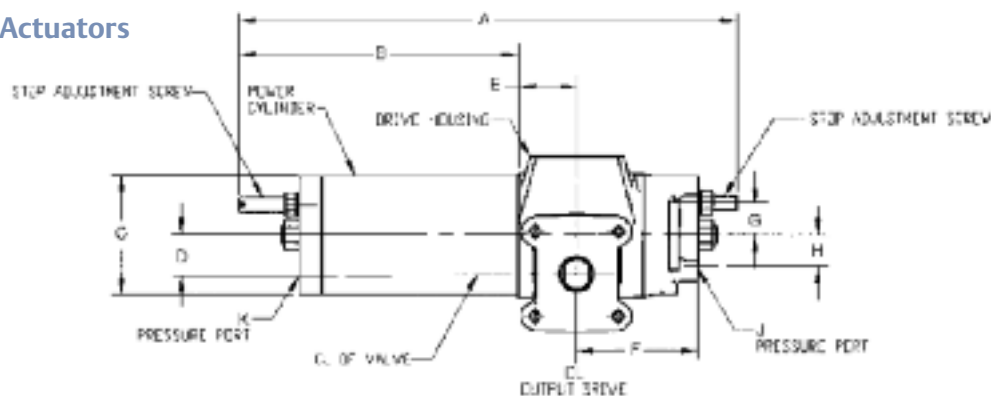
Note: Not Certified dimensional drawings. Such drawings available on request. Contact factory with correct model designation and serial number.

All dimensions are expressed in inches.



Dimensions – CBA-Series (Pneumatic) – metric

Double-Acting Actuators CBAXXX

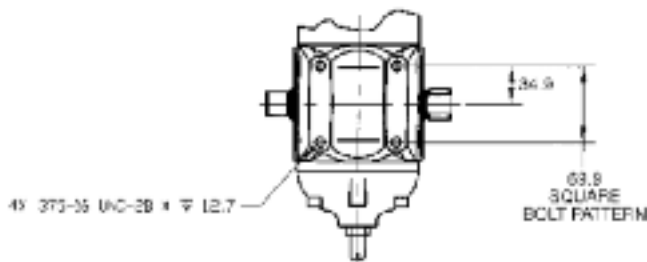


Actuator Model	A	B	C	D	E	F	G	H	J/K	L	M	N
CBA315	359.8	187.5	82.6	27.8	47.8	87.8	23.8	23.9	1/4" NPT	.313-18 UNC	9.7	57.2
CBA420	417.3	217.6	108.0	34.9	54.1	111.0	27.9	27.9	3/8" NPT	.375-16 UNC	12.7	76.2
CBA520	418.1	219.2	136.7	34.9	53.5	111.0	27.9	27.9	3/8" NPT	.375-16 UNC	12.7	76.2
CBA525	488.1	250.9	136.7	42.9	65.0	127.0	31.8	28.4	3/8" NPT	.500-13 UNC	12.7	88.9
CBA725	492.7	260.1	190.5	42.9	64.2	127.0	31.8	28.4	3/8" NPT	.500-13 UNC	12.7	88.9

Actuator Model	P	Q	R	S	T	U	V	W	X	Y	Z	AA
CBA315	.313-18 UNC	28.6	73.8	147.6	19.1	56.4	131.5	15.6 15.73	26.2	95.3	27.8	22.15 22.25
CBA420	.375-16 UNC	38.1	85.1	169.9	19.1	71.3	158.9	22.09 21.09	26.2	117.5	35.1	28.5 28.6
CBA520	.375-16 UNC	38.1	85.1	169.9	19.1	71.3	158.9	22.09 21.09	26.2	117.5	35.1	28.5 28.6
CBA525	.500-13 UNC	44.5	111.1	222.3	28.4	88.9	192.6	28.33 24.47	38.1	146.1	42.9	38.02 38.12
CBA725	.500-13 UNC	44.5	111.1	222.3	28.4	88.9	192.6	28.32 28.48	38.1	146.1	42.9	38.02 38.12

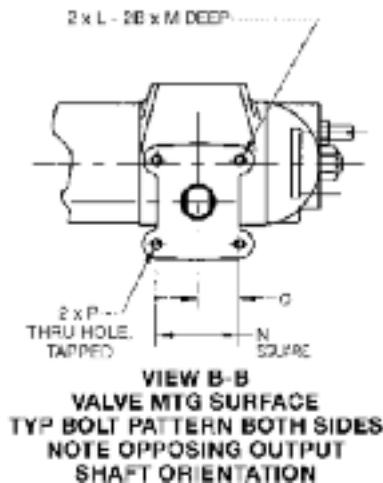
Note: Not Certified dimensional drawings. Such drawings available on request. Contact factory with correct model designation and serial number.

All dimensions are expressed in millimeters.



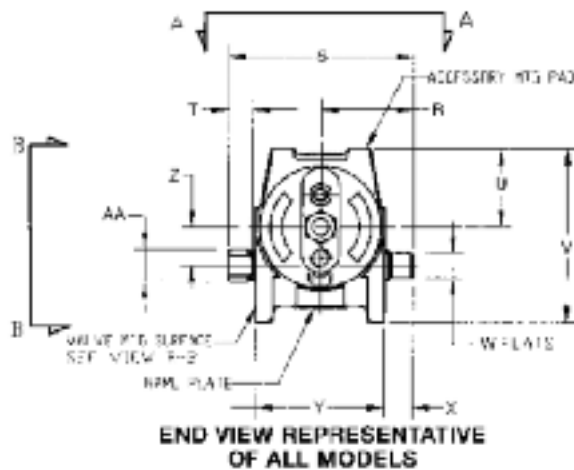
ACTUATORS SHOWN ROTATED TO FULL CLOCKWISE POSITION

VIEW A-A
ACCY MTG PAD



VIEW B-B

VALVE MTG SURFACE
TYP BOLT PATTERN BOTH SIDES
NOTE OPPOSING OUTPUT
SHAFT ORIENTATION



END VIEW REPRESENTATIVE
OF ALL MODELS